PERTUSSIS

CDNA NATIONAL GUIDELINES FOR PUBLIC HEALTH UNITS

Revision history			
Version	**Date**	**Revised by**	**Changes**
1.0	19 February 2009	VPDS OHP	Updated URL links and addition of link to state and territory legislation
2.0	30 January 2013	Pertussis SoNG WG	New CDNA case definition added, 'Mechanism of transmission' acknowledges experimental evidence of airborne spread, added option of contacting case directly if high priority, other minor clarifications.
3.0	April 2015	CDNA	Updated advice from the *Therapeutic Guidelines: Antibiotic 2014*

The Series of National Guidelines have been developed in consultation with the Communicable Diseases Network Australia and endorsed by the Australian Health Protection Principal Committee (AHPPC). Their purpose is to provide nationally consistent advice and guidance to public health units (PHUs) in responding to a notifiable disease event. These guidelines capture the knowledge of experienced professionals, built on past research efforts, and provide advice on best practice based upon the best available evidence at the time of completion.

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1. Summary

Case and contact management is challenging for pertussis. The evidence base is limited and the epidemiological behaviour of *Bordetella pertussis* is not well understood. This partly explains why pertussis is a poorly controlled bacterial vaccine-preventable disease.

Public health priority
High. Begin public health follow up as soon as possible, generally within 1 working day (see Response Times in Section 9). The objective of public health follow up of pertussis cases is to prevent disease in infants <6 months of age with particular focus on exposures in household, child care and health care settings. Therefore highest priority should generally be given to cases who are nucleic acid test (NAT) or culture confirmed and:

- If the case is a child under 5 years of age, follow up the younger cases (<2 years) before the older cases
- other age groups where cases are already known to have close contacts that include infants <6 months of age
- are women known to be in the last month of pregnancy

No action is required for cases notified >21 days after the onset of paroxysmal cough (if the onset is known) or >28 days after the onset of any cough unless they are reported to be part of a cluster.

Case management
It is the responsibility of the treating doctor to treat infectious cases and consider the need for further public health action for any high risk contacts. For cases considered high public health priority (see above) contact the treating doctor or case to identify any contacts that are infants <6 months of age or people who may transmit pertussis to these infants, and advise on management of case and contacts as necessary. For other cases, an advisory letter may be sent to the treating doctor, as required.

Contact management
For cases considered high public health priority, counsel their close contacts and facilitate antibiotic prophylaxis where necessary. Recommend that contacts' immunisations be updated if appropriate.

2. The disease

Infectious agents
The bacillus *Bordetella pertussis (B. pertussis)*

Reservoir
Humans are the only reservoir for *B. pertussis*. Adults and adolescents are often an important source of infection for infants.[1]

Mode of transmission
Pertussis is mainly transmitted by large droplet infection or direct contact with discharges from respiratory mucous membranes of infectious people. Indirect spread via contaminated objects occurs rarely.[2] There is some experimental evidence which supports airborne transmission over distances greater than one metre.[3]

Clinical presentation and outcome
Pertussis is a prolonged coughing illness with clinical manifestations that vary by age. An initial catarrhal phase is characterised by the insidious onset of runny nose, sneezing, absent or low-grade fever, and a mild occasional cough. The cough gradually becomes paroxysmal (after 1–2 weeks), and may end in vomiting, cyanosis and/or a characteristic high-pitched inspiratory 'whoop'. Paroxysms may recur with subsequent respiratory illnesses for many months after the onset of pertussis.[1] Fever is generally minimal throughout the course of the illness and sub-clinical infections may occur.[1] Infants are less likely to have the inspiratory whoop and a significant catarrhal stage and are more likely to present with gagging, gasping, cyanosis, apnoea or non-specific signs such as poor feeding or seizures.[4]

Adults and children partially protected by vaccination can present with illness ranging from a mild cough illness to classic pertussis, though this may be without the inspiratory whoop. In adults, post-tussive vomiting (when present) is strongly suggestive of pertussis.[4] The most common complication is pneumonia caused either by *B. pertussis* infection itself, or co-infection with viral respiratory pathogens such as respiratory syncytial virus (RSV).[4] Encephalopathy is a rare complication.[4]

Incubation period
The incubation period ranges from 4-21 days, usually 7 to 10 days.[1]

Infectious period
Cases are infectious from the onset of catarrhal symptoms. Communicability gradually decreases and is negligible 3 weeks after onset of cough. Secondary attack rates of 80% among susceptible household contacts have been reported.[1] For public health purposes, a case is considered non-infectious (even if the PCR result is still positive) at whichever time is the earlier of:

- 21 days after the onset of any cough, or
- 14 days after onset of paroxysmal cough (if the onset is known), or
- when they have completed 5 days of a course of an appropriate antibiotic.

Persons at increased risk of disease
Infants under 6 months of age account for the vast majority of pertussis hospitalisations and deaths; Australian data for 2009-2010 indicate a case fatality rate of less than 0.5% in infants too young to be protected by vaccine.[5, 6]

Disease occurrence and public health significance
Globally, pertussis remains a major health problem despite widespread vaccination programs. In 2009, 195 000 deaths were estimated from the disease, mostly in developing countries.[7] In Australia, pertussis is the most common acute vaccine preventable disease with epidemics occurring approximately every 3-4 years and the timing of epidemic activity varying across

jurisdictions.[8] It has only relatively recently been widely recognised as a common disease of older children and adults.

3. Routine prevention activities

Apart from direct case and contact management of pertussis, the following activities are routine prevention activities at the population level.

Vaccination
Pertussis immunisation is recommended for all Australian children with the first dose of pertussis-containing vaccine given from 6 to 8 weeks of age[9], followed by doses at 4 and 6 months, a booster from 3.5-4 years of age[10] and a further booster at 12-17 years of age. Lower-dose dTpa vaccines suitable for use in adolescents and adults have been available since 2001. Since 2003, dTpa vaccine has been recommended for healthcare workers and people working or living with infants, including parents, grandparents, those planning pregnancy and childcare workers who have not previously had a dose of the acellular vaccine. Immunity following vaccination begins to wane after as little as 4-5 years. [11]

Increase awareness
Amongst the general public, it is important to raise awareness of:

- early diagnosis and treatment of cases, by encouraging people with coughing illnesses to seek early medical attention. This will facilitate timely treatment of pertussis cases (to reduce infectiousness) and follow up of high risk contacts.
- respiratory hygiene around babies, by encouraging people with coughing illnesses to avoid contact with infants <6 months of age until a diagnosis is made and they are no longer infectious.

Amongst general practitioners and other clinicians, it is important to promote ongoing clinical education about pertussis that outlines appropriate diagnosis, treatment and the identification and management of contacts.

4. Surveillance objective

The objective of surveillance for pertussis is:

- To monitor and analyse the epidemiology of the disease, including the impact of immunisation, and to report on findings to inform effective and efficient prevention strategies.

The objective of public health follow up of pertussis cases is:

- To prevent disease in infants <6 months of age with particular focus on exposure in household, childcare and healthcare settings

5. Data management

Within 3 working days of notification, enter confirmed and probable cases onto the jurisdictional notifiable diseases database. As soon as practicable, check and enter vaccination details for cases under 5 years of age.

6. Communications

- Within 1 working day of becoming aware of a death from pertussis, notify the state/territory Communicable Diseases Branch of the case's age, sex, date of onset, vaccination history, laboratory status, likely source of infection and follow up action taken.
- The state/territory Communicable Diseases Branch should notify the case details to the CDNA secretariat and update the 'died' field in the national notifiable diseases database.
- The state/territory Communicable Diseases Branch should also be notified of significant pertussis exposures in healthcare settings.

7. Case definition

Probable and confirmed cases of pertussis are notifiable in Australia. The current surveillance case definition can be found at: http://www.health.gov.au/casedefinitions.

8. Laboratory testing

Testing guidelines

Routine testing of patients is at the discretion of the treating doctor. Public health personnel should encourage testing to confirm any probable cases where contacts <6 months of age have been reported. Laboratory testing of asymptomatic contacts should be discouraged.

With increasing availability, nucleic acid testing (NAT) should be considered the diagnostic method of choice, unless the presentation is delayed until after 4 weeks from any cough onset, or more than 3 weeks after commencement of paroxysmal cough, after which time serological testing may be more useful for diagnosis.

Nucleic acid testing (NAT)

- Nucleic acid testing (NAT) (also known by the proprietary name of PCR) has largely replaced culture for the diagnosis of pertussis. NAT is more sensitive than culture and has optimal sensitivity during the first 3 weeks of cough. After the fourth week of cough, sensitivity declines as the amount of bacterial DNA in the nasopharynx diminishes.[12]
- NAT can be positive for 5 weeks or longer; refer to Section 2 for guidance on the infectious period for public health purposes.
- NAT testing after 5 days of appropriate antibiotics is unlikely to be of benefit and is generally not recommended.[12]
- Nasopharyngeal aspirates or nasopharyngeal swabs with Dacron™ or rayon tipped swabs are optimal and calcium alginate swabs should not be used. Throat swabs may also be used, although they suffer from lower sensitivity. Swabs for NAT should be sent to the laboratory dry – not in transport medium.
- Further information including technique for collection of nasopharyngeal swab or aspirate can be found at: http://www.cdc.gov/pertussis/clinical/diagnostic-testing/specimen-collection.html

Culture

- The sensitivity of nasopharyngeal culture decreases rapidly after cough onset and is highly dependent on specimen quality. Cultures are rarely positive after 2 weeks from the onset of the catarrhal stage of the illness, or one week of paroxysmal cough, or for more than a few days after starting antibiotics.
- If it is proposed to collect samples for culture of *B. pertussis*, the laboratory should be contacted beforehand to enable swabs and culture media to be processed promptly.
- Nasopharyngeal (not throat) cultures should be collected either by aspiration or with a flexible, deep nasal swab. The swab should be inoculated directly onto special pertussis culture medium or into transport medium, or both, according to the laboratory's specific instructions. The technique is illustrated at http://www.cdc.gov/pertussis/clinical/diagnostic-testing/specimen-collection.html
- Cultures may take as long as 2 weeks to be finalised, so results may not be clinically useful.

Serology

- Although serological testing of pertussis has not been standardised, it was the predominant diagnostic test until recently. *Bordetella*-specific IgA directed against whole-cell lysate has been the most widely used test, particularly in adults and adolescents who present late in the course of their illness, when both culture and NAT are likely to be negative. The serological assays in use are, however, changing, with increasing use of purified antigens such as pertussis toxin (PT) alone or in combination with filamentous haemagglutinin (FHA). International standards for anti-PT and anti-FHA IgG and IgA have become available and should allow for greater standardisation of assays in the future.
- The sensitivity and specificity of serology is low. Serology may be useful if a clinically compatible illness has been present for more than two weeks, but is not recommended in children <2 years old as they are less likely to develop IgA antibodies and because phlebotomy can be difficult for inexperienced venepuncturists.
- Depending on which antigens are used in the assay, a positive *Bordetella* serological result may also occur in parapertussis.
- IgA and IgG may be elevated for an unknown period (reported as 1 year[13] but may be as long as 2 years) in an adult or adolescent after vaccination, therefore caution should be taken in interpreting serological results in a recently vaccinated person.
- Bordetella-specific IgG and IgA rise during acute infection. If only a convalescent sample is available the current suggestive criteria for recent infection in the absence of recent vaccination include an elevated IgA antibody level to whole-cell *B. pertussis* or an elevated IgG and/or IgA to pertussis toxin or other combination antigens. Commercial and in-house validated assays utilising PT with or without FHA are now being introduced.
- *Bordetella* IgM serology is available using commercial kits, but is currently not considered sufficiently sensitive and specific for guiding public health decisions. An IgM response may follow infection in young children in whom the IgA response is not yet mature.

For further information on laboratory testing refer to the Public Health Laboratory Network (PHLN) laboratory case definitions website:
www.health.gov.au/internet/main/publishing.nsf/Content/Laboratory+case+definitions-1

9. Case management

Response times

Begin the follow up within 1 working day of notification of high priority cases who are NAT/culture confirmed, and more likely to be in contact with infants <6 months of age. The principles for prioritising the workload among NAT/culture confirmed high priority cases are:

- If the case is a child <5 years, follow up the younger cases (<2 years) before the older cases
- Follow up any case in a woman known to be in the last month of pregnancy
- Follow up where the case is already known to be in contact with infants <6 months of age or women in the last month of pregnancy
- Follow up where the case is known to attend or work in a setting where there is likely to be contact with infants <6 months of age or women in the last month of pregnancy (e.g. certain childcare and healthcare settings)

Active public health action (e.g. exclusion, antibiotic use) is not required for cases notified >21 days after date of onset of paroxysmal cough (if the onset is known) or >28 days after the onset of any cough—unless they are reported to be part of a cluster—as they are unlikely to be infectious.

Response procedure

Case investigation

For cases given priority as outlined above:

Response will usually be carried out in collaboration with the treating doctor.

Public health personnel should:

- Provide advice on case and contact management. The Public Health Unit may send a letter and fact sheet (see example fact sheet, Appendix 1) to the treating doctor recommending case and contact management
- Investigate the case using a pertussis case investigation form (see example form, Appendix 2)
- For cases under 5 years of age, check and record primary vaccination status (including source of verification)

For any other cases meeting the current case definition:

Public health personnel may:

- Offer, as resources permit, to assist the treating doctor with cases when either high risk contacts or clusters are identified by the treating doctor.

Exposure Investigation

Where feasible for cases given priority, investigate the possible source of exposure-contact with a confirmed or suspected case/s.

Case treatment

Antibiotics given early in the catarrhal stage may ameliorate the disease but may have little effect on symptoms if given later.[14] Importantly, antibiotics reduce the period of communicability[15] and should be initiated as soon as possible. If treatment starts any later than 14 days from onset of any cough, by the time 5 days of treatment are completed, the case is already close to the end of their infectious period (21 days). Treatment is the responsibility of the attending doctor. However, it should be noted that azithromycin, especially the syrup form,

may be difficult and/or expensive to obtain and that specific advice may be required. For recommended treatment see the latest edition of *Therapeutic Guidelines: Antibiotic*.[16] In 2015 the recommendations were updated and are outlined in Table 1:

Table 1. Recommended antibiotic treatment and post exposure prophylaxis for pertussis by age group

Age Group	Macrolides			Non-macrolide alternative
	Azithromycin	Clarithromycin	Erythromycin*	Trimethoprim + Sulfamethoxazole
<1 month	10mg/kg daily for 5 days	Not recommended (as no safety data)	Not recommended (as associated with pyloric stenosis)	not recommended
1-5 months	10mg/kg daily for 5 days	7.5mg/kg twice a day for 7 days (up to 1g/day)	Erythromycin 10mg/kg (up to 250mg) every 6 hours for 7 days Erythromycin (ethyl succinate formulation) child >1 month 10mg/kg up to 400mg every 6 hours for 7 days	Child ≥2months 4+20mg/kg (up to 160+800mg) twice a day for 7 days
Infants ≥6 months and children	10mg/kg (up to 500mg) on Day 1, followed by 5mg/kg (up to 250mg) on Days 2-5	7.5mg/kg twice a day for 7 days (up to 1g/day)	Erythromycin 10mg/kg (up to 250mg) every 6 hours for 7 days Erythromycin (ethyl succinate formulation) child >1 month 10mg/kg (up to 400mg) every 6 hours for 7 days	4+20mg/kg (up to 160+800mg) twice a day for 7 days
Adults	500mg on Day 1 followed by 250mg daily on Days 2-5	500mg twice a day for 7 days	Erythromycin 250mg every 6 hours for 7 days. Erythromycin (ethyl succinate formulation) 400mg every 6 hours for 7 days	160+800mg twice a day for 7 days
Pregnancy	Pregnant women with onset of pertussis or exposure within a month of expected delivery should receive antibiotic therapy. It is the responsibility of the treating doctor to select the most appropriate antibiotic. Erythromycin (Category A) has variable absorption and frequent gastrointestinal side-effects. Azithromycin (Category B1) has better absorption. Clarithromycin is a Category B3 antibiotic. [16]			

Therapeutic Guidelines: Antibiotic notes there is currently no clinical evidence to recommend the use of roxithromycin for the management of pertussis. In vitro evidence indicates it is relatively ineffective. [17]

* Erythromycin, whilst efficacious for prophylaxis, is not recommended due to poor tolerability. Erythromycin for this reason is not currently listed in the most recent edition of *Therapeutic Guidelines: Antibiotic (2014).*

Education
The case or relevant care-giver should be advised about the nature of the infection and the mode of transmission. The fact sheet is useful for this purpose (see Appendix 1). Cases should be advised to avoid contact with infants and women in the last month of pregnancy.

Isolation and restriction
Exclusion from work, school, preschool, and child care, and restricted attendance from other settings, especially where there are infants, should be recommended for cases until they are no longer infectious, i.e. until:

- 21 days after the onset of any cough, or
- 14 days after the onset of paroxysmal cough (if the onset is known) , or
- they have completed 5 days of a course of an appropriate antibiotic.

In hospital settings, infectious cases should be managed with droplet precautions and accommodated in a single room.[18]

Active case finding
None routinely required, except in special situations (see Section 12 Case in a healthcare worker in a maternity ward or newborn nursery).

10. Environmental evaluation

Not required.

11. Contact management

Identification of contacts
The aim of identifying contacts is to:

- Alert them to the possibility that they could develop disease, and
- Recommend antibiotic prophylaxis for the subset who are infants <6 months of age or people who may transmit pertussis to these infants.

Direct contact with respiratory droplets from the case is likely to pose a significant risk of transmitting infection. [14]

Contact definition
In general terms, close contacts are people with face-to-face exposure (within 1 metre) to an infectious case,[14] for a single period of at least one hour (based on expert opinion). In the absence of evidence concerning the minimum duration of exposure required to lead to infections in neonates, a neonate exposed to an infectious case for less than one hour may warrant being considered a close contact. In addition, close contacts are usually considered to include family and household members and, in other settings, people who have stayed overnight in the same room as the case.[*] All close contacts or their carers should receive information about pertussis symptoms (e.g. fact sheet).

In addition, a subset of close contacts are considered high-risk contacts because of the severity of disease or the likelihood of transmitting infection to those at risk of severe disease and are

[*]In non-household settings, the size of the room and degree of separation of the case from others should be considered when close contacts are being identified.

recommended antibiotic prophylaxis. For the purposes of this guideline, high-risk contacts are infants <6 months of age and people who may transmit pertussis to them.

In the event of exposure in the household setting, high-risk contacts include:

- expectant parents (or carers) in the last month of pregnancy
- all household members where there is an infant <6 months present.

In any setting, close contacts of a case who are considered high-risk contacts include:

- healthcare staff working in a maternity ward or newborn nursery (where women in the last month of pregnancy or infants <6 months are present)
- childcare staff who look after infants aged <6 months
- children who have close contact in child care with children <6 months of age
- women in the last month of pregnancy.

Management of immunodeficient contacts should be made on a case by case basis.

Prophylaxis

Passive immunisation

Normal human immunoglobulin (NHIG) is not effective against pertussis. There is efficient transfer of protective maternal antibodies across the placenta with a half life of 6 weeks and disappearance by 4 months.[19] As pertussis antibodies wane over several years, there will be little humoral antibody protection for the infant unless the mother has been vaccinated or infected shortly before or during pregnancy.[19]

Active immunisation

Not applicable in the management of defined contacts. However immunisation should be promoted according to NHMRC recommendations.

Antibiotic prophylaxis

There is little evidence that antibiotic prophylaxis reduces secondary transmission outside of the household setting.[15, 20] The recommended antibiotics may have associated side effects (especially gastrointestinal) that reduce compliance. Therefore antibiotic prophylaxis should be limited to contacts that include infants <6months of age or people who may transmit pertussis to these infants (high-risk contacts). Antibiotic prophylaxis is only useful if given as soon as possible after **first** contact with an infectious index case [4, 14] Based on the preceding statements and considering the decline in infectiousness during the infectious period, the timeline for providing antibiotic prophylaxis to high-risk contacts should be within 14 days of **first** contact with an infectious case and prophylaxis is recommended in the settings outlined in Table 2. Regimens for antibiotic prophylaxis are the same as for treatment of cases–See Table 1 under Section 9 Case Management.

Due to lack of evidence of effectiveness from these settings, antibiotic prophylaxis is not considered valuable in other settings such as primary schools, high schools, tertiary institutions and work places. If there are prolonged or multiple chains of transmission, the benefit of antibiotic prophylaxis is likely to be minimal.[21] Circumstances in which further contact occurs with an index case satisfying the recommendations for antibiotic prophylaxis, should be assessed to determine the risk of severe disease in contact/s and the benefit of repeat antibiotic prophylaxis.

Use of Table 2:

- The table does not cover all possible scenarios; other settings or exposures of shorter duration where high-risk individuals have been exposed may warrant consideration for prophylaxis.

Presumptions and notes:

- Transmission is by respiratory droplets requiring close 'household-type' contact [1]
- Transmission is usually considered to require exposure within 1 metre for a single period of 1 hour. There is no evidence to guide decisions in relation to repeated shorter exposures over a period of time with a cumulative total greater than one hour.
- While antibodies to pertussis begin to wane within a year after vaccination in adults, they remain above pre-vaccination levels for 10 years. [12] The 10th edition of the *Australian Immunisation Handbook* recommends that no further doses of dTpa vaccine be given routinely until 10 years after the first dose.[6]

Table 2. Recommendations for the management of contacts in various settings

Setting		Provide advice[A,B]	Antibiotics[C]	Exclusion[D] of non or incompletely vaccinated[E] people
Household	Where household contacts include an incompletely vaccinated child <6 months or woman in the last month of pregnancy	Household	All household members, regardless of vaccination status[F]	Not applicable
	All other households	Household	Nil	Not applicable
Child care[G] sporadic case	Where there is an incompletely vaccinated child <6 months in room (who is not the case)	All staff and parents	All children in room with <3 doses of vaccine	Children: exclude for 5 days while on antibiotics or 14 days (from first exposure to infectious case) if they do not take antibiotics
			Staff who have not had a pertussis-containing vaccine in last 10 years[H]	Staff: not excluded while taking 5 days of antibiotics or recommend exclusion for 14 days (from first exposure to infectious case) if they do not take antibiotics
	Where all children are ≥6 months	All staff and parents	Children: Nil	Children: not excluded if they remain well
			Staff: Nil	Staff: not excluded if they remain well

[A] These contacts should be alerted to the possibility that they could develop disease and to seek early medical assessment if they develop symptoms consistent with pertussis.
[B] Recommend vaccination to contacts, health care workers, and those who work with children who are incompletely vaccinated as they are likely to benefit in the future if vaccinated.
[C] Antibiotic prophylaxis is recommended for these contacts of pertussis cases, and should be given within 14 days of first exposure to an infectious case. Regimens for antibiotic prophylaxis are the same as for treatment of cases. See Table 1 under Section 9 Case Management.
[D] Any contacts that develop symptoms should, where possible, be excluded (immediately) from childcare, preschool, school, health care and workplace settings and seek early medical assessment.
[E] In the childcare setting, any child that has received <3 doses of vaccine is considered incompletely vaccinated
[F] Choice of an appropriate antibiotic for use in pregnancy is the responsibility of the treating doctor. See Table 1 under Section 9 Case Management
[G] Childcare settings include long day care, family day care or settings where children aged 4 years or less are in care before they start their first year in a school setting (this can be called preschool or kindergarten in certain jurisdictions). See also Section 12 'Special situations: Cases among children in child care'.
[H] Staff are regarded as vaccinated if they have had a pertussis-containing vaccine in the last 10 years

Setting		Provide advice[A,B]	Antibiotics[C]	Exclusion[D] of non or incompletely vaccinated[E] people
Child care with 2 or more cases in the same room within a single incubation period [I]	Where there is an incompletely vaccinated child <6 months in room (who is not the case)	All staff and parents	All children in the room regardless of vaccination status	Children: exclude for 5 days while on antibiotics or 14 days (from first exposure to infectious case) if they do not take antibiotics
			All staff in the room regardless of vaccination status	Staff: not excluded while taking 5 days of antibiotics or recommend exclusion for 14 days (from first exposure to infectious case) if they do not take antibiotics
	Where all children are ≥6 months	All staff and parents	All children in room with <3 doses of vaccine	Children: exclude for 5 days while on antibiotics or 14 days (from first exposure to infectious case) if they do not take antibiotics
			Staff who have not had a pertussis containing vaccine in last 10 years[8]	Staff: not excluded while taking 5 days of antibiotics or recommend exclusion for 14 days (from first exposure to infectious case) if they do not take antibiotics
Healthcare settings where infants <6 months or women in their last month of pregnancy are present (including neonatal unit, maternity ward)[J]	Case is staff member of unit / ward or an infectious patient who has not been appropriately isolated	All staff and parents	Infants <6 months exposed to the case within 1 metre for >1 hour[K]	Not applicable
			Parents or carers of infants <6 months/women in last month of pregnancy[6] exposed to the case within 1 metre for >1 hour	Not applicable

[I] See Section 12 Outbreaks. Due to the variety of childcare settings where two or more cases may be epidemiologically linked and the absence of strong evidence for the effectiveness of antibiotic prophylaxis in these settings, a case by case assessment will usually be required to determine the appropriate response.

[J] See also 'Special situations: Case in a healthcare worker in a maternity ward or newborn nursery

[K] In the absence of evidence concerning the minimum duration of exposure required for a neonate to be infected, a neonate exposed to an infectious case for less than one hour may warrant being considered a close contact and receiving antibiotic prophylaxis.

Setting		**Provide advice[A,B]**	**Antibiotics[C]**	**Exclusion[D] of non or incompletely vaccinated[E] people**
			All staff exposed within 1 metre for >1 hour in the unit who–in the next 3 weeks–are to care for neonates or women in the last month of pregnancy regardless of vaccination status	Staff: need only be excluded (immediately) if they become symptomatic and are to be excluded whilst considered infectious. In situations in which asymptomatic staff contacts have been recommended and refused antibiotics (e.g. an outbreak) recommend exclusion OR restrict from working with infants <6 months and women in the last month of pregnancy (for 14 days from first exposure to the infectious case)
Other healthcare settings	Case is patient or staff	As identified	Women in the last month of pregnancy. Consider antibiotics for patients at risk of severe disease	Nil
Kindergarten/ Preschool or School`	Case is student or teacher	Parents of children in same class	Nil	Nil

Education
Public health personnel should manage the distribution of information to contacts (usually in the form of a letter and fact sheet) through the treating doctor, or if required, directly or via the case or other intermediary (e.g., director of the childcare centre, school principals, hospital infection control staff, etc). Contacts should be advised that they are infectious as soon as they develop catarrhal symptoms and should be excluded (immediately) from child care, preschool, school, healthcare and workplace settings and seek early medical assessment.

Isolation and restriction
For childcare and healthcare settings, refer to the Exclusion section of Table 2.
The general principles are to recommend exclusion of unvaccinated or incompletely vaccinated contacts (as outlined in Table 2) until:

- the expiry of 14 days from their first exposure to the infectious case, or
- they have completed 5 days of a course of an appropriate antibiotic.

The period of exclusion for 14 days from first exposure considers the highly (but waning) infectious nature of pertussis and covers the usual length of an incubation period (7-10 days). The benefit of exclusion is to a) protect the child contact who has not received 3 effective doses of vaccine and therefore is not protected against disease and b) reduce the risk of transmission from the child contact to any other person in the setting who is at increased risk of severe and/or complicated disease. If parents do not follow an exclusion request despite public health personnel attempting to convince them of the need to do so, then specific jurisdictional public health legislative provisions, where they exist, may need to be applied.

In hospital settings, patients with pertussis should be in respiratory isolation until they are no longer infectious (i.e. until they have received at least 5 days of a course of an appropriate antibiotic). Ensure staff follow droplet precautions[18] (including wearing a surgical mask) during close contact with cases.

12. Special situations

Cases among children in child care
In this document child care refers to long day care, family day care or settings where children aged 4 years or less are in care before they start their first year of school (this can be called preschool or kindergarten in certain jurisdictions).

In addition to usual case and contact investigation, it is important to emphasise to parents and directors of childcare facilities the need to establish each child's immunisation status, the importance of all children complying with the immunisation schedule and the need to remain alert for symptoms in their child/ren. It is also important to recommend that the facility remain alert for respiratory illness for at least an incubation period (21 days) after last contact with the infectious case and ensure appropriate management of any further cases.

In the family day care setting where one or more infants <6 months of age are being cared for, a case in the carer or a member of the carer's family may warrant temporary closure, as exclusion of the case is generally not practicable.

Cases among children in playgroup

Exposures in the playgroup setting need to be considered on a case by case basis. Considerations need to include:

- the length of time spent outdoors (which is considered a lower risk exposure)
- the length of exposure time
- the age of the children involved.

Cases among children in kindergarten/preschool or school

If advice is sought from the Public Health Unit in these situations, it is important to emphasise to parents and principals/directors of these facilities the need to establish each child's immunisation status, the importance of all children complying with the immunisation schedule and the need to remain alert for symptoms in their child/ren. It is also important to recommend that the facility remain alert for respiratory illness for at least one incubation period (21 days) after last contact with the infectious case, that the facility report cases of respiratory illness and ensure appropriate management of any further cases.

Case in a healthcare worker in a maternity ward or newborn nursery

For probable or confirmed cases, consult immediately with facility management and staff from infection control or staff health to institute a management plan appropriate to the facility. This should include procedures to:

- Confirm the diagnosis through expert clinical review and laboratory testing (ideally by PCR). Concurrent investigation of alternative diagnoses (e.g. *Mycoplasma pneumoniae*, *Chlamydophila pneumoniae*, viral (such as adenovirus, metapneumovirus, parainfluenza, influenza A and B, rhinovirus, RSV), and non-infectious causes) will assist in interpretation of equivocal or indeterminate serological results or where there may be co-infection.
- Carry out active surveillance for pertussis among exposed patients, staff, students, volunteers and visitors.
- Staff members, students and volunteers detected through active surveillance with symptoms suggestive of pertussis should be immediately excluded and requested to undergo prompt medical evaluation.
- Manage cases appropriately. See section 9 Case management.
- Define and identify contacts for prophylaxis and exclusion. Refer to list of high risk contacts (see contact definition in Section 11) and recommendations in Table 2.
- Review staff health records to ensure that all have been protected in line with current immunisation recommendations.

Cases who are pregnant

Pertussis infection early in pregnancy may provide subsequent protective antibodies to a neonate. As the timing of delivery is not predictable, a pregnant woman with pertussis onset within a month of expected delivery and her household contacts should receive antibiotic therapy[22] as recommended in Table 1. If the baby is born before the mother or household contacts have completed 5 days of a course of appropriate antibiotic treatment, then the baby should receive antibiotic prophylaxis.

Outbreaks

When outbreaks of pertussis are identified, additional control measures should be considered. An outbreak is defined as two or more cases which share a plausible epidemiological link e.g. clustered in time and place (such as in the same room, ward or similar confined setting where transmission is suspected to have occurred in that setting). An outbreak case definition of a cough illness lasting $\geq$14 days may be used to count cases,

if one case has been laboratory confirmed. Depending on the people affected and nature of the setting, control strategies may also include:

- active case finding
- epidemiological studies to determine risks for infection
- alerts to doctors in the community
- media alerts to the wider community
- cocooning vaccination initiatives
- other measures as appropriate, including community-wide promotion of vaccination.

If an outbreak occurs in a healthcare facility, an outbreak management team should be convened, including a senior facility manager, Public Health Unit staff if appropriate, an infection control practitioner and appropriate clinical staff.

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14. Appendices

Appendix 1 – Pertussis fact sheet
Appendix 2 – Pertussis case investigation form (see separate form)
Appendix 3 – PHU Check list

15. Jurisdiction specific issues

Links to State and Territory Public Health Legislation, the Quarantine Act and the National Health Security Act 2007.
http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-state-legislation-links.htm

Appendix 1 Pertussis fact sheet

Whooping cough (Pertussis)

What is Whooping cough?

Whooping cough can be a life threatening infection in babies. Whooping cough in babies can lead to apnoea (pauses in normal breathing), pneumonia, feeding problems and weight loss, seizures, brain damage and, in some cases, death. Older children and adults get whooping cough too and can pass it on to babies.

What are the symptoms?

Whooping cough usually begins like a cold with a blocked or runny nose, tiredness, mild fever and a cough.

- The cough gets worse and severe bouts of uncontrollable coughing can develop.
- Coughing bouts can be followed by vomiting, choking or taking a big gasping breath which causes a "whooping" sound. The cough can last for many weeks and can be worse at night.
- Some newborns may not cough at all but they can stop breathing and turn blue. Some babies have difficulties feeding and can choke or gag.
- Older children and adults may just have a cough that lasts for many weeks. They may not have the whoop.

How is it spread?

- Whooping cough is spread when an infectious person coughs bacteria into the air which can be inhaled by people nearby. If they are not treated early, people with whooping cough are infectious in the first three weeks of their illness.
- Whooping cough spreads easily through families, childcare centres and at school.

Who is at risk?

- Anyone can get whooping cough. People living in the same household as someone with whooping cough are especially at risk.
- Immunisation reduces the risk of infection but immunity fades over time. You can still get whooping cough even if you've been immunised.

How is it prevented?

Whooping cough vaccines provide good protection from infection but immunity fades which means that boosters are needed.

Immunisation for babies

- Babies need to be immunised at 2 months, 4 months and 6 months. The first dose can be given as early as 6 weeks of age.
- Getting your baby vaccinated on time gives them some protection when they are most at risk of severe illness.
- If your baby's vaccines are overdue, see your GP now to catch up.

Immunisation for older children

- A whooping cough booster can be given from 3.5 years of age.
- A second whooping cough booster is given in high school generally through the school immunisation program.
- Check if your child has been vaccinated. Look at their immunisation book (for example, blue book), speak to your GP or ring the Australian Childhood Immunisation Register on 1800 653 809.

Immunisation for adults
A booster for adults is recommended for:

- Both parents when they are planning a pregnancy, or just after the baby is born
- Other adult household members, grandparents and carers of infants under 12 months of age.
- Adults working with young children, especially health care and child care workers.

If you are a close contact of someone with whooping cough:

- If you have been exposed to someone with whooping cough early in their illness while they are infectious, watch out for symptoms and see your doctor if you get a new cough.
- Some babies and some pregnant women need antibiotics to prevent whooping cough infection if they have had significant contact with an infectious person.

How is it diagnosed?
Your doctor may ask about your symptoms and whether you've had any contact with whooping cough. If your doctor thinks you have whooping cough, a swab from the back of the nose can confirm the diagnosis.

How is it treated?

- Some babies may need treatment in hospital or in intensive care.
- Antibiotics are used to treat whooping cough in the early stages and can help prevent spreading whooping cough to others. People who are not treated early with the right antibiotics can spread the infection in the first 3 weeks of their coughing. After 5 days of antibiotics, you are normally no longer infectious.
- The cough often continues for many weeks, despite antibiotics.

What is the public health response?
Doctors and laboratories must confidentially notify cases of pertussis to the local Public Health Unit. Public Health Unit staff can advise on the best way to stop further spread. Infectious children are restricted from going to pre-school and school. Unimmunised contacts may be excluded from child care unless they take the recommended antibiotics.

Further information
Immunise Australia website
http://www.immunise.health.gov.au/internet/immunise/publishing.nsf/Content/home
Other jurisdictional information
Contact details for PHUs

Pertussis Case Investigation Form

..... **Public Health Unit** Outbreak ID: .....

Completed by: ..... Date entered into database: ...../...../.....

Telephone: ..... Fax: .....

NOTIFICATION:

Date PHU notified: ...../...../..... Date initial response: ...../...../.....

Notifier:..... Organisation: .....

Telephone: ..... Fax: ..... Email: .....

Treating Dr:.....

Telephone: ..... Fax: ..... Email: .....

CASE DETAILS: **UR No:**.....

Name: .....

First name *Surname*

Date of birth: ...../...../..... Age: ..... Years ..... Months Sex: ☐ Male ☐ Female .....

Name of parent/carer: .....

☐ Aboriginal ☐ Torres Strait Islander ☐ Aboriginal & Torres Strait Islander ☐ Non-Indigenous ☐ Unknown

English preferred language: ☐ Yes ☐ No – *specify* ..... Ethnicity – *specify* .....

Permanent address: .....

..... Postcode: .....

Home tel: ..... Mob: ..... Email: .....

Occupation: ..... Work telephone: .....

Temporary address *(if different from permanent address)* : .....

..... Postcode: .....

Telephone: ..... Mob: ..... Email: .....

General Practitioner: Dr .....

Address:..... Postcode: .....

Telephone: ..... Fax: ..... Email: .....

CLINICAL DETAILS:

Clinical evidence: ☐ Paroxysms ☐ Inspiratory whoop☐ Post cough vomiting

Onset of catarrhal stage: ...../...../..... ☐ Unknown Onset of cough: ...../...../..... ☐ Unknown

Onset of paroxysmal cough: ...../...../..... ☐ Unknown

Cough still present: ☐ Yes ☐ No ☐ Unknown Cough duration: .....

Hospitalised: ☐ Due to the condition ☐ No ☐ Unknown ☐ Hospital acquired Hospital:

.....

Date: ...../...../..... to ...../...../.....

Complications: ☐ Yes – *specify* ..... ☐ No ☐ Unknown

Outcome: ☐ Survived ☐ Died Date of death: ...../...../..... ☐ Died of condition ☐Unknown

LABORATORY: Laboratory: ..... First specimen date: ...../...../.....

B. pertussis PCR/NAT +ve ☐ Yes ☐ No ☐ Unknown

Pertussis IgA +ve ☐ Yes ☐ No ☐ Unknown

Isolation of *B. pertussis* ☐ Yes ☐ No ☐ Unknown

Pertussis toxin IgG seroconversion ☐ Yes ☐ No ☐ Unknown

No laboratory testing; epidemiologically linked ☐ Yes ☐ No ☐ Unknown

---

EXPOSURE PERIOD:

Date: ...../...../..... to Date: ...../...../.....
(Onset of catarrhal stage – 21 days) (Onset of catarrhal stage – 4days)

NOTE: Use onset of first cough if onset of catarrhal stage unknown

During this time was there contact with confirmed/suspected case(s) ☐ Yes ☐ No ☐ Unknown

Name / NID: ..... Telephone: ..... Contact type: .....

Name / NID: ..... Telephone: ..... Contact type: .....

PLACE ACQUIRED:

☐ State/territory ☐ Other Australian state/territory – *specify* .....

☐ Unknown ☐ Other country – *specify* .....

PERTUSSIS VACCINATION DETAILS:

Dose	Date	Type
1	...../...../.....	.....
2	...../...../.....	.....
3	...../...../.....	.....
4	...../...../.....	.....
5	...../...../.....	.....

Vaccination status: ☐ Age-appropriate ☐ Incomplete ☐ Not vaccinated ☐ Unknown

Source of vaccination history: ☐ ACIR/VIVAS ☐ Health record ☐ Self reported ☐ Not applicable

---

INFECTIOUS PERIOD:

Date: ...../...../..... to Date: ...../...../.....
(Onset of catarrhal stage) (Onset of cough + 21 days / paroxysmal cough + 14 days)

NOTE: Use onset of first cough if onset of catarrhal stage unknown

Appropriate antibiotic commenced: ☐ Yes ☐ No Date: ...../...../.....

☐ Azithromycin ☐ Clarithyromycin ☐ Erythromycin ☐ Trimethoprim + Sulfamethoxazole ☐ Other, specify .....

Non infectious 5 days later: Date: ...../...../.....

During this time did the case have contact with infants <6months of age in the following settings?

☐ Household – *specify* ..... Telephone: ..... Dates: .....

☐ Other overnight stays e.g. educational/residential facility – *specify* ..... Telephone: ..... Dates attended: .....

☐ Childcare – *specify* ..... Telephone: ..... Dates attended: .....

☐ Preschool/school – *specify* ..... Telephone: ..... Dates attended: .....

☐ Hosp/healthcare facility – *specify* ..... Telephone: ..... Dates attended: .....

☐ Other contact with infants <6months or pregnant women – *specify* ..... Telephone: ..... Dates: .....

Was the case excluded from childcare/ school/ other high risk setting? ☐ Yes ☐ No ☐ Unknown

---

NOTIFICATION DECISION: ☐ Confirmed – Pertussis case ☐ Probable – Pertussis case

---

CONTACT MANAGEMENT:

Type of contact	Number of contacts	Advice Provided	Antibiotics recommended	Number excluded from childcare
Household Total children ..... Total adults	Children < 6 months with < 3 DTPa* ..... Women in last month of pregnancy	Children: ..... Adults:	Children: ..... Adults:	Children: ..... Adults: .....
Attends childcare Total children ..... Total adults	Children < 6 months with < 3 DTPa* ..... Children > 6 months with < 3 DTPa* ..... Staff >10 yrs since last DTPa* ..... Staff in last month of pregnancy	Children: ..... Adults:	Children: ..... Adults:	Children: ..... Adults: .....
Other significant contacts Total children ..... Total adults	Children < 6 months with < 3 DTPa* ..... Women in last month of pregnancy.....	Children: ..... Adults:	Children: ..... Adults:	Children: ..... Adults: .....

* Use of the term DTPa refers more broadly to any pertussis containing vaccine

COMMENTS:

Appendix 3 PHU Checklist

Case ID number: _____

For cases given priority (see Section 9 Case management):

Contact the case's doctor to:

- □ Obtain patient's history
- □ Confirm results of relevant pathology tests
- □ Provide advice on case and contact management

If required, make contact with the case or case's care giver to:

- □ Identify likely source of infection
- □ Review vaccination status
- □ Confirm onset date and symptoms of the illness
- □ Recommend exclusions and restrictions
- □ Identify contacts and obtain contact details
- □ Complete *Pertussis Investigation Form*
- □ Provide *Pertussis fact sheet*

If required, make contact with the case's contacts to:

- □ Assess risk of pertussis (susceptibility, exposure history)
- □ Recommend antibiotic prophylaxis if appropriate
- □ Explain symptoms, exclusions and restrictions (child care)
- □ Provide with *Pertussis fact sheet*

For all other cases:

- □ Where high risk contacts or clusters are identified by the treating doctor, offer (as resources permit) to assist with management of these contacts

Confirm case

- □ Assess information against case definition

Contact ACIR to:

- □ Verify immunisation status

Other issues:

- □ For a pertussis death, report details to state/territory CDB
- □ Where defined groups of people have been exposed (e.g., schools, child care), contact the person in charge to explain the situation and to provide letters to exposed people
- □ Enter case data onto notifiable diseases database